The use of an LCD projector for thermal analysis of small objects

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Basic Idea

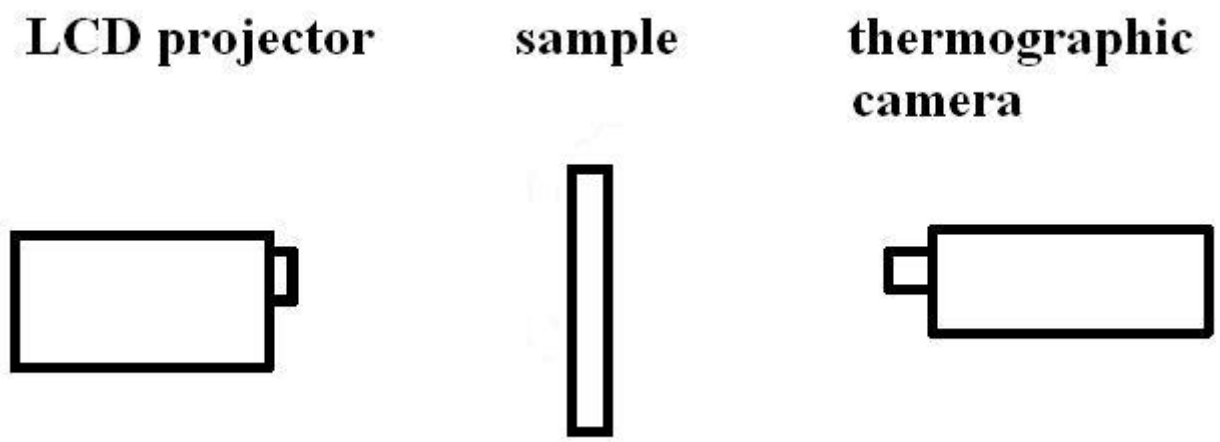
- AC analysis
- Small objects
- Heat ~ cos(ωt)
- How to achieve this?

⇒ LCD projector

⇒ Software

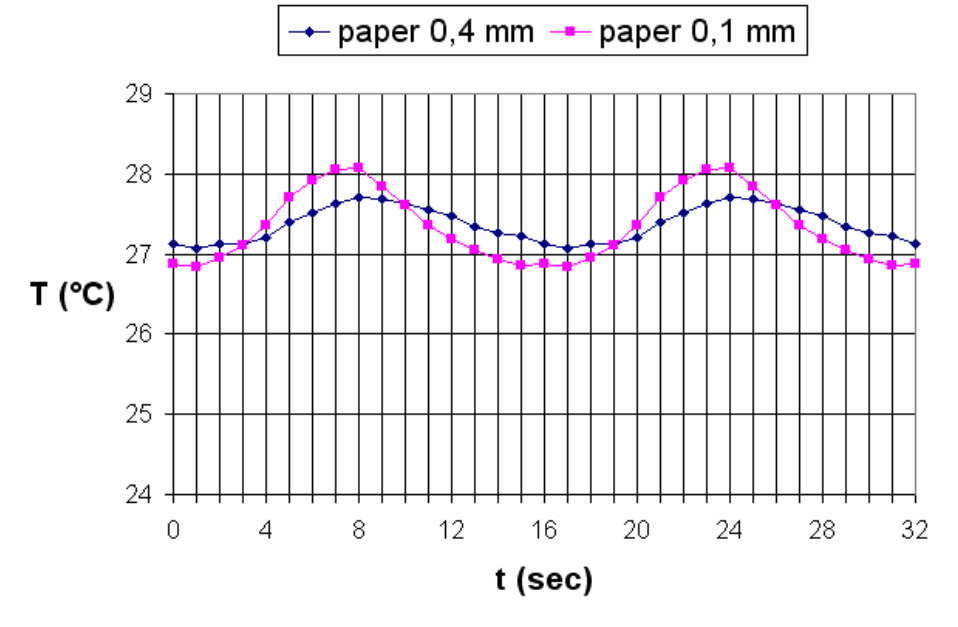
Example of projected image

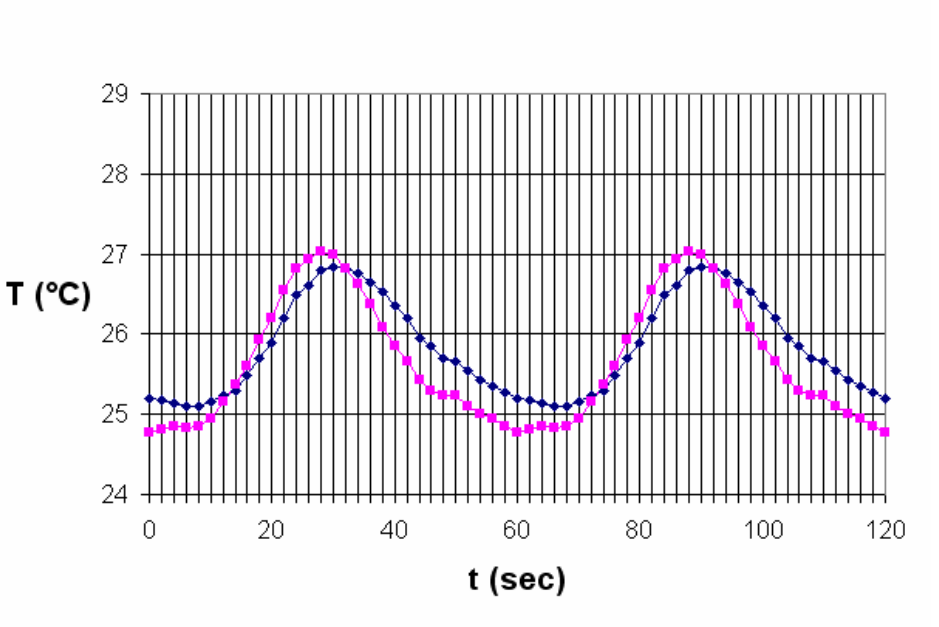
Experimental setup



First experimental results

Test objects: paper 0.4mm and paper 0.1mm of thickness



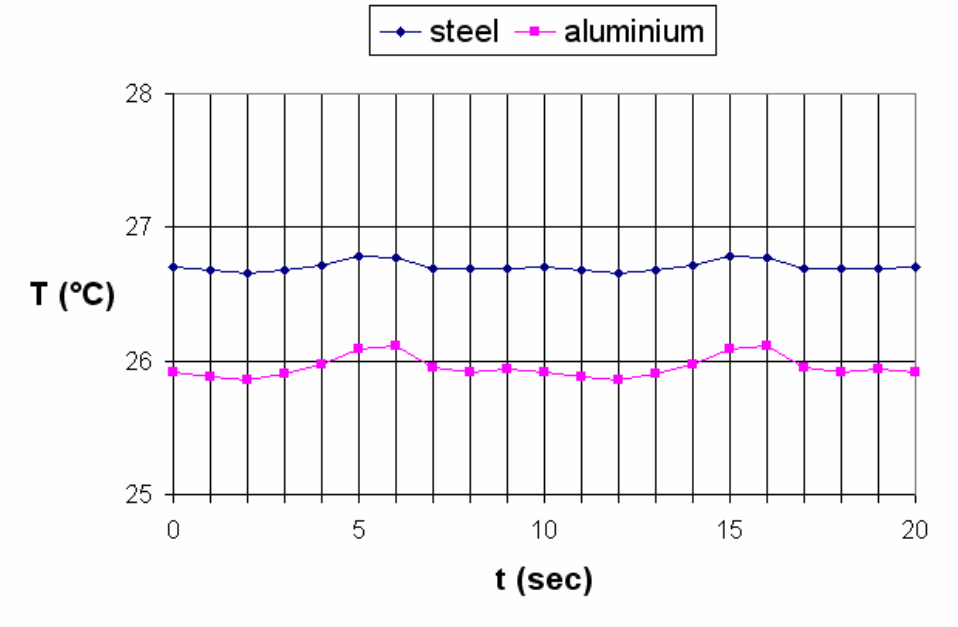


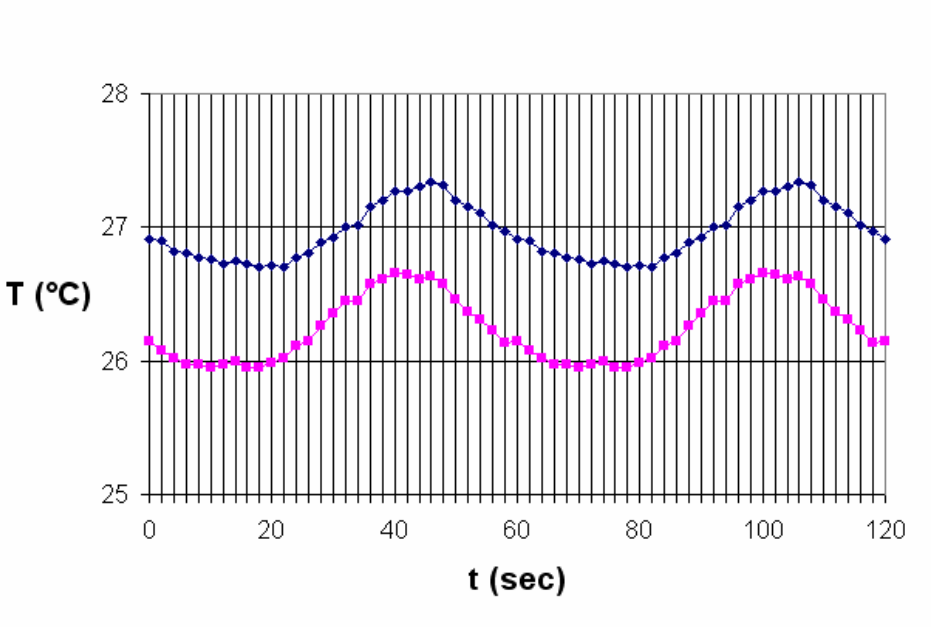
Period = 16 sec; frequency = 63 mHz
Phase shift = 0.393 rad = 22.5°

Period = 60 sec; frequency = 17 mHz
Phase shift = 0.314 rad = 18.0°

First experimental results (2)

Test objects: steel (0.4mm of thickness) and aluminium (0.35mm)



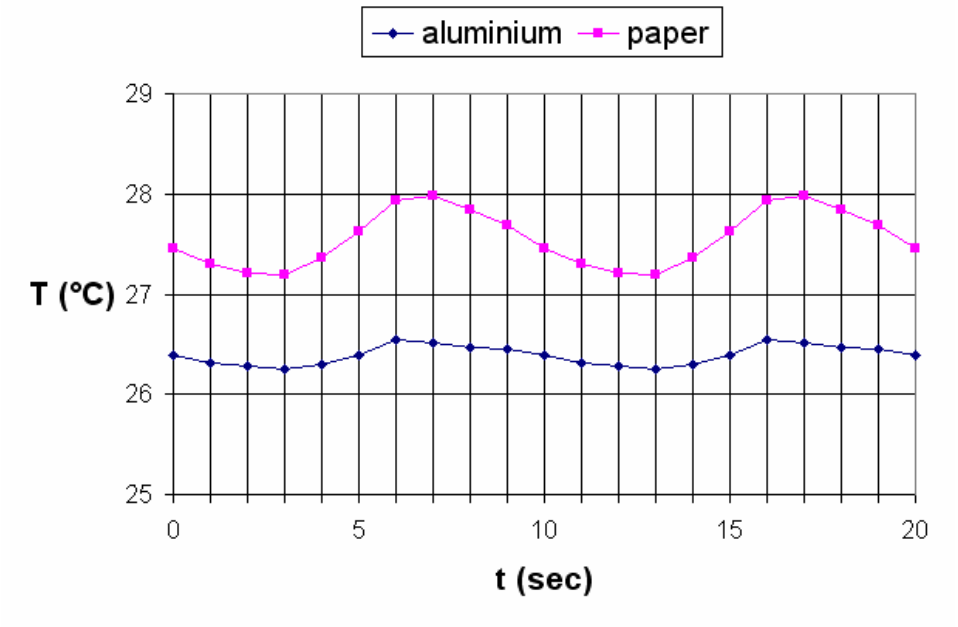


Period = 10 sec; frequency = 100 mHz
Phase shift = 0.0 rad = 0.0°

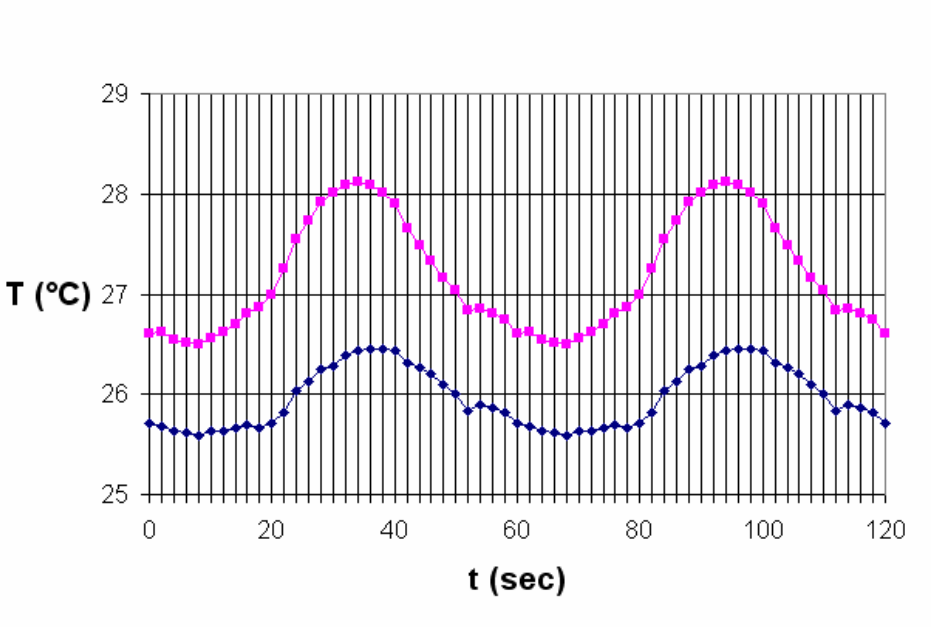
Period = 60 sec; frequency = 17 mHz
Phase shift = 0.262 rad = 15.0°

First experimental results (3)

Test objects: paper (0.1mm of thickness) and aluminium (0.35mm)



Period = 10 sec; frequency = 100 mHz
Phase shift = 0.0 rad = 0.0°

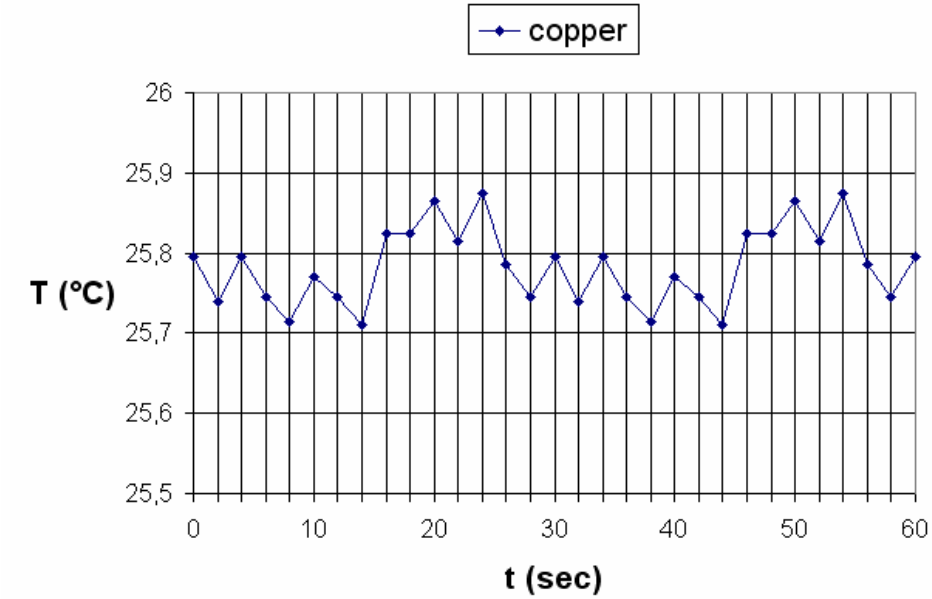


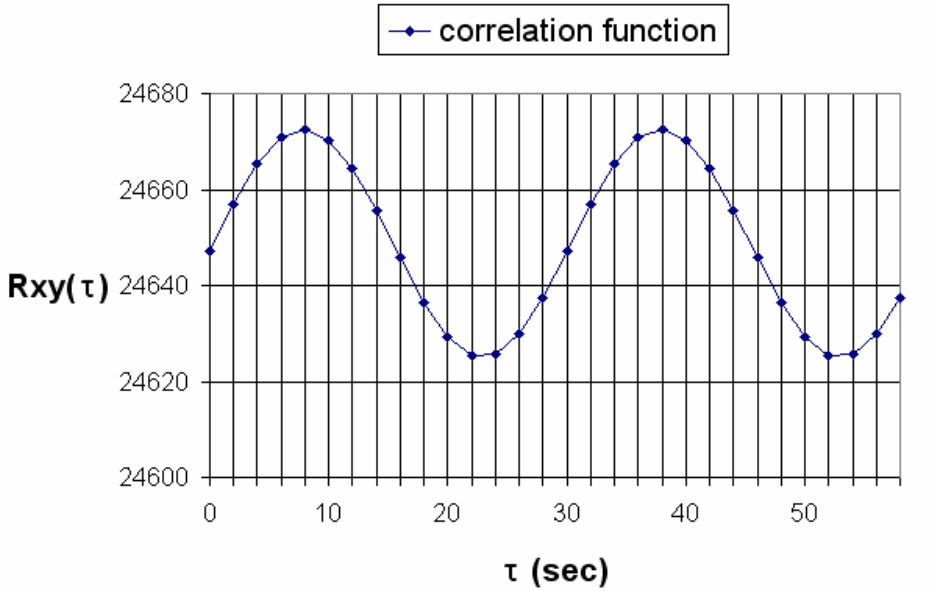
Period = 60 sec; frequency = 17 mHz
Phase shift = 0.105 rad = 6.0°

Correlation

$$R(\tau) = \int \cos(\omega t)\, T(t+\tau)\, dt$$

Correlation with input signal (cos(ωt)) gives clearer result





Test object: copper – 0.83mm
Period = 30 sec; frequency = 33 mHz

Conclusions

- Method works
- Only first results
- heat = f(t) and heat = f(x,y,t) are both possible
- Only change software